ASTR 288C – Lecture 3

Monday, 21 September 2009

Finding Information II: Literature

Introduction

The **reputation and success** of an astronomer/astrophysicist is a direct result of efforts on the following areas.

- **Solid work**: Your body of work needs to be solid, at the very least, and you need to build up a reputation that others can trust your work (your supervisor, colleagues at your and other institutions). See Lecture 1 about reproducibility of your work.
- **Innovative thinking**: Don't just reproduce what others in your field are doing; you need to stay ahead of the curve, develop novel ideas and advance your field. You can do this be keeping up with the literature, attending conferences and meeting, talking to other researchers, and collaborating with people outside your immediate area of research.
- **Be a successful proposer of new observations**: If you are successful in getting new data (with ground- and space-based instruments), you will likely find new and exciting ways of learning about the universe and get to publishable results fast. Harvesting the data archives or relying on your supervisor's data is not enough. Writing successful proposals requires writing a *lot* of proposals. It is not unusual for proposals to be rejected. Study the referees' comments and use them to make the proposal better, then resubmit it.
- **Be a successful fundraiser**: At some point of your career, you need to show your ability to raise funds through grant proposals. This is a long process and it takes years to establish a successful track record of your fund raising abilities. Keep in mind that money gives you're the ability to travel to many meetings to present your results, have state-of-the-art lab equipment, cover your own salary, hire students and establish your own research group, etc. If you are a successful fundraiser, it is more likely that someone will hire you. As with observing proposals it is not unusual for funding proposals to be rejected, so it is important to write many of them, and to improve and resubmit ones that are not accepted.
- **Serve on Review Panels**: You benefit from the peer review of your proposals and papers. At some point, you need to serve the community by being a peer reviewer, either for journal articles or during observing/grant review panels. Serving on these panels can take a lot of effort and time, but it presents the unique opportunity to

establish yourself as one of the experts in your field. As a side benefit, you hear about results of others first.

- **Knowledge sharing**: Your science is only as good as your peers' perception of your work. You need to get out of your office/lab, spread the news, and let others know what you do. This can be done by giving talks at your institution (seminars or colloquia), at other institutions, at national and international meetings (contributed and invited talks), giving public talks (invited), press releases (danger dealing with the press!), media interviews (newspapers, news web sites, broadcast companies, etc. You want to be the "go-to guy" in your field), and by publishing your results in refereed journal and conference proceedings.
- **Work fast and hard**: If you work fast, you can publish more than others, and earlier than others (e.g. using public data). Build up a reputation that you can do research well and do it fast.
- **Stay ahead of the curve**: As a scientist, you need to be aware of everything that is going on in your field, and in related fields. Therefore you need to read a lot of journal articles, be aware of press releases, and observe your field. In science, information is key, and you need to excel in finding relevant information fast and digesting it.

Simply put: You want to be the best in your field (not easy as there are a lot of bright minds in the field, some of them without lives).

Much of the items above are directly related to the scientific literature. Common forms of scientific literature are discussed next.

Un-Refereed Publications

Unrefereed publications are publications that were submitted and published without a peer or "referee" evaluating the article. You simply write an article and publish. Unrefereed publications are a "lower" form of publication as they have not been evaluation for validity by others, and may contain certain mistakes/omissions (both minor and major). Therefore you have to take them with a grain of salt and be skeptical to some degree. Examples of unrefereed publications are:

- **Conference Proceedings**: These can be a direct result of a talk that you gave a meeting/workshop/conference. They are usually a brief (usually 2–4 pages) paper that summarizes your results without giving all of the technical details or background information.
- **Astronomers Telegrams** (ATel; www.astronomerstelegram.org): Instantaneous communication method of timely results, such as novae, supernovae, active stars, active pulsars, active galactic nuclei, comets, gamma-ray bursts, etc. The idea behind ATels is to replace the dated and historic Central Bureau for Astronomical Telegrams (CBAT) which sent out short telegrams (literally!), called the International Astronomical Union

Circulars (IAUCs). Once you register with ATel, you can post immediately. The ATel will then be posted on the ATel Web site right away, and you can opt that an e-mail alert be sent out to a group, an e-mail list that you provide, or both. ATels are also distributed as daily e-mail digest. Sign up to these dailies to stay informed or visit the site often. There is a Mac OSX "widget" for ATel that is very useful.

- **IAUC and CET** (www.cfa.harvard.edu/iau/cbat.html): Central Bureau for Astronomical Telegrams (CBAT) is the official worldwide clearinghouse for new discoveries of comets, Solar System satellites, novae, supernovae, and other transient astronomical events. The first Central Bureau was formally created in the 1880s in Kiel, Germany. They are a paid subscription service (both sending and receiving CBATs and IAUC costs money). They are not as fast as ATels as there is one person in charge of CBATs/IAUCs who needs to receive the draft, read it, and manually post it. They are not available at night and sometimes not available on weekends. The ATel is a more modern version of CBETs and is free, but some people consider CBATs/IAUCs more prestigious (because they are being vetted by an IAU staff member).

Refereed Publications

These are publications that went through a (sometimes lengthy) peer-review process. The peer-review process is essential in scientific publislishing and is intended to guarantee that the science presented in the paper is of sufficient high quality. It also protects against plagiarism and forgery. After submission, the editor of the journal assigns a scientific editor. This scientific editor chooses one or more experts in the field and send the paper to them to get opinions on the paper. It is essential that the anonymity of the referees is guaranteed throughout the peer-review process, and after publishing of the paper, to protect the referees and the effectiveness of the peer-review process. This is so authors are not able to contact the referee(s) directly. It also prevents possible retaliation for an unfavourable review. The referees usually have a four-week period to write a (sometimes lengthy) report on the paper, the data analysis and interpretation of the results, to comment on the originality of the science, and to determine if it warrants publication.

After the peer-review, the scientific editor will notify the author(s) of the outcome of the refereeing process. Many papers do not survive the peer-review process. The outcome can be

(i) accepted as is (very rare!),
(ii) (accepted pending minor changes,
(iii) accepted pending substantial changes,
(iv) rejected with the possibility of re-submission after the referees' comments have been adequately addressed, or
(v) rejected with no resubmission possible.

The peer-review process is usually iterative and authors are requested to make the changes the referee(s) have suggested and address any comments. After

completing this, and if all parties are involved in the process are satisfied, the paper will be sent to production editors who do the typesetting and prepare the figures and tables for inclusion on the paper. The production manager will then send the final manuscript back to the authors for proofreading. This proofreading process is now much faster due to electronic e-annotations in MS Word or Adobe Acrobat. This is the last chance to correct errors in the paper.

Finally the author will be sent the "page charges" and the paper will be published after the page charges have been covered. In scientific publishing, authors usually have to pay for their own papers being published (due to the small circulation of the journals). The authors also need to sign a "publication agreement" and transfer the copyrights to the publisher.

Scientific Journals

The major journals for astronomy are:

- **The Astrophysical Journal (ApJ):** Begun in 1895 by George E. Hale and James E. Keeler, *The Astrophysical Journal* is often considered the foremost research journal in the world devoted to recent developments, discoveries, and theories in astronomy and astrophysics. Many of the classic discoveries of the twentieth century have first been reported in this journal, which has also presented much of the important recent work on quasars, pulsars, neutron stars, black holes, solar and stellar magnetic fields, X-rays, and interstellar matter. *The Astrophysical Journal Supplement Series* has been published since 1953 in conjunction with the journal. *ApJ* uses an own "style file" for LaTeX. This, and *The Astronomical Journal* are the go-to journals for astrophysics done in North America.

- **The Astronomical Journal (AJ):** Founded in 1849 by Benjamin A. Gould, the *AJ* publishes original astronomical research, with an emphasis on significant scientific results derived from observations, including descriptions of data capture, surveys, analysis techniques, and astrophysical interpretation. It takes a broad view of astronomy, extending from the Solar System to observational cosmology with a tradition of papers discussing dynamical processes. The *AJ* serves an international community that includes authors, scientists and students through efficient and accessible communication of the science and associated techniques. *AJ* uses an own "style file" for LaTeX. *AJ* is similar to *ApJ*, but is a more classical astronomical journal for optical astronomers.

- **Astronomy & Astrophysics (A&A):** *A&A* is the most important European journal and the European equivalent of *ApJ* and *AJ*. *A&A* is an international journal which publishes papers on all aspects of astronomy and astrophysics (theoretical, observational, and instrumental) independently of the techniques used to obtain the results.

- **Monthly Notices of the Royal Astronomical Society (MNRAS):** *MNRAS* is one of the world's leading primary research journals in astronomy and astrophysics, as well as one of the longest established. It publishes the results of original research in positional and dynamical astronomy, astrophysics, radio astronomy, cosmology, space research and the design of astronomical instruments. *MNRAS* welcomes submissions from astronomers world-wide, but about ine-thirds of its content originates in the UK. It is run entirely by astronomers and, receiving no financial support from anywhere, makes its decision to publish only on scientific judgements. Papers are rigorously refereed and fully linked to the ADS database, so they have a high impact. Practical advantages to publishing in *MNRAS*: no page charges (except for colour in the printed version), publication every 10 days.

- **Publications of the Astronomical Society of the Pacific (PASP):** *PASP* is the technical journal of the Astronomical Society of the Pacific. It publishes refereed papers on astronomical research covering all wavelengths and distance scales as well as papers on the latest innovations in astronomical instrumentation and software. The *PASP* has been published continuously since 1889.

- **Science Magazine:** One of the world's leading journals of original scientific research, global news, and commentary. Only few astronomical articles per issue, if any. Wide circulation, and as an author, you can reach many scientists across disciplines. Suited for “high impact science” results that have a broader impact on many fields of science. Example: “Do Black Holes Seed the Formation of Galaxies?” Downside of publishing in *Science*: Highly oversubscribed, difficult to get in. Articles are less technical compared to the articles in the journals above. Articles are usually written in MS Word instead of LaTeX, which makes typesetting of formulas and equation laborious.

- **Nature:** Weekly, international, interdisciplinary journal of science, published in London, England. *Nature* is the world's most highly cited interdisciplinary science journal, according to the 2007 Journal Citation Report Science Edition (Thomson, 2008). Its Impact Factor is 28.751. The impact factor of a journal is calculated by dividing the number of citations in a calendar year to the source items published in that journal during the previous two years. Nature only publishes ≈1 article about astronomy per issue and it is very difficult to get an article accepted. Journal editors have more power than in other journals and have the liberty to reject (or even accept!) papers before being sent to the referees. Authors are advised to send a “pre-submission inquiry” to the scientific editor before submission of the manuscript to see if the article stands a chance to be accepted. Each submitted article has to survive one of the most difficult peer-review processes. More than 90% of all articles submitted to *Nature* are rejected.

Therefore (because it is so difficult to get in and because it is not a journal about astronomy), papers are highly regarded and can significantly advance an astronomer's career. Downside: Not every library/institution has a subscription (expensive!). Therefore, articles published in *Nature* are not as easy accessible (try to find an article in *Nature* and print it out – you will soon see how difficult/impossible it is). Many authors have mixed feelings about *Nature*.

Types of Articles

The main types of articles in scientific publishing are:

- **Article**: In-depth, complete description of original research usually of between around 5 and 20 pages. Articles are the main form of scientific publishing.
- **Supplementary Article**: Long form of publication that includes long data tables (also as electronic files on the web to download). Very few people read these articles in full. The serve as a place for others to grab long tables, FITS files, as part of a "survey" study. Example: "Globular Clusters in the Sloan Digital Sky Survey." This is a catalog of 100 million objects.
- **Review Articles**: These are invited articles and very prestigious. They usually present an overview and review of our knowledge of an entire field, written by an expert in the field. Highly cited. Do not cover original research but the work others.
- **Letters** (not to be confused with "Letters to the Editor" in newspapers or journals): Short (<4 pages) and rapid (weeks instead of months) form of communication of an important result that has a broad impact. Very prestigious.
- **Research Notes**: Short description of an original research results of lesser importance.

Where to Find Literature

You can either go directly to the journal publisher's web site:

ApJ:	http://www.iop.org/EJ/journal/apj
AJ:	http://www.iop.org/EJ/journal/aj
A&A:	http://www.aanda.org/
MNRAS:	http://www.wiley.com/bw/journal.asp?ref=0035-8711&site=1
PASP:	http://www.journals.uchicago.edu/toc/pasp/current
Science:	http://www.sciencemag.org/
Nature:	http://www.nature.com/nature/index.html

It is often easier to g directly to the **Astrophysics Data System (ADS)** web site at http://adsabs.harvard.edu/ . The ADS is a digital library that contains almost all journal articles (and even books) about astronomy & astrophysics, currently containing 7.4 million records. The main body of data in the ADS consists of bibliographic records, which are searchable through customizable

query forms, and full-text scans of much of the astronomical literature, which can be browsed or searched via a full-text search interface. Integrated in its databases, the ADS provides access and pointers to a wealth of external resources, including electronic articles, data catalogs and archives.

SAO/NASA ADS Astronomy Query Form for Mon Feb 16 13:06:14 2009

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Hint: When searching by publication date, omit the starting publication month to match all entries (including those with unknown publication month--indicated by 00).

Send Query | Return Query Form | Store Default Form | Clear

Databases to query: ☑ Astronomy ☐ Physics ☑ arXiv e-prints

Authors: (Last, First M, one per line) ☑ SIMBAD ☑ NED ☑ ADS Objects

☐ Exact name matching

☐ Require author for selection

(◉ OR ○ AND ○ simple logic)

Object name/position search

☐ Require object for selection

(Combine with: ◉ OR ○ AND)

Publication Date between (MM) (YYYY) and (MM) (YYYY)

Enter Title Words ☐ Require title for selection

(Combine with: ◉ OR ○ AND ○ simple logic ○ boolean logic)

Enter Abstract Words/Keywords ☐ Require text for selection

(Combine with: ◉ OR ○ AND ○ simple logic ○ boolean logic)

Return 200 items starting with number 1

Astrophysics Abstract Server, astro-ph:
http://arxiv.org/archive/astro-ph

This is another great tool you should take advantage of. astro-ph provides an archive of preprints. These preprints are usually posted directly on astro-ph by authors whose papers have been accepted. By doing so, papers are available in an electronic form (either as PDF, PS, other – including source files and original figures) weeks before the paper is being published by the journal. Best of all: It's completely free and you don't even need to have a subscription to the journal. Make sure to sign up for the daily mailing list of posted articles (usually sent out before midnight) and make it a habit to go through this mailing list on a daily list – read all titles, some abstracts – and pick 1–2 articles per day that you read in its entirety! This will greatly enhance your knowledge of current astrophysical research.

Fri, 13 Feb 2009

[36] arXiv:0902.2199 [ps, pdf, other]
Swift X-ray and UV monitoring of the Classical Nova V458 Vul (Nova Vul 2007)
J.-U. Ness, J.J. Drake, A.P. Beardmore, D. Boyd, M.F. Bode, S. Brady, P.A. Evans, B.T. Gaensicke, S. Kitamoto, C. Knigge, I. Miller, J.P. Osborne, K.L. Page, P. Rodriguez-Gil, G. Schwarz, B. Staels, D. Steeghs, D. Takei, M. Tsujimoto, R. Wesson, A. Zijlstra
Comments: 10 pages, 6 figures; accepted for AJ
Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**; Galaxy Astrophysics (astro-ph.GA)

[37] arXiv:0902.2197 [ps, pdf, other]
Gravitational waves from the fragmentation of a supersymmetric condensate
Alexander Kusenko, Anupam Mazumdar, Tuomas Multamaki
Comments: 14 pages, 6 figures
Subjects: **Cosmology and Extragalactic Astrophysics (astro-ph.CO)**

[38] arXiv:0902.2179 [ps, pdf, other]
Binarity of Transit Host Stars - Implications on Planetary Parameters
S. Daemgen, F. Hormuth, W. Brandner, C. Bergfors, M. Janson, S. Hippler, Th. Henning
Comments: 9 pages, 3 Figures. Accepted by A&A
Subjects: **Solar and Stellar Astrophysics (astro-ph.SR)**; Earth and Planetary Astrophysics (astro-ph.EP)

[39] arXiv:0902.2177 [ps, pdf, other]
Spectroscopic orbits and variations of RS Oph
E. Brandi, C. Quiroga, J. Mikolajewska, O.E. Ferrer, L.G. Garcia
Comments: 12 pages, 10 figures, 4 tables. Astronomy & Astrophysics (accepted)
Subjects: **Solar and Stellar Astrophysics (astro-ph.SR)**; Galaxy Astrophysics (astro-ph.GA)

[40] arXiv:0902.2158 [ps, pdf, other]
Study of the atmospheric refraction in a single mode instrument - Application to AMBER/VLTI
Sylvie Robbe-Dubois (FIZEAU), Stephane Lagarde (FIZEAU), Yves Bresson (FIZEAU), Romain G. Petrov (FIZEAU), Marcel Carbillet (FIZEAU), Etienne Lecoarer (LAOG), Frederik Rantakyrö, Isabelle Tallon-Bosc (CRAL), Martin Vannier (FIZEAU), Pierre Antonelli (FIZEAU), Gregoire Martinot-Lagarde (GA, DTI), Alain Roussel (FIZEAU), Daniel Tasso (FIZEAU)
Comments: Mon. Not. R. Astron. Soc. (2009) accepted
Subjects: **Instrumentation and Methods for Astrophysics (astro-ph.IM)**

Swift X-ray and UV monitoring of the Classical Nova V458 Vul (Nova Vul 2007)

J.-U. Ness, J.J. Drake, A.P. Beardmore, D. Boyd, M.F. Bode, S. Brady, P.A. Evans, B.T. Gaensicke, S. Kitamoto, C. Knigge, I. Miller, J.P. Osborne, K.L. Page, P. Rodriguez-Gil, G. Schwarz, B. Staels, D. Steeghs, D. Takei, M. Tsujimoto, R. Wesson, A. Zijlstra

(Submitted on 12 Feb 2009)

We describe the highly variable X-ray and UV emission of V458 Vul (Nova Vul 2007), observed by Swift between 1 and 422 days after outburst. Initially bright only in the UV, V458 Vul became a variable hard X-ray source due to optically thin thermal emission at kT=0.64 keV with an X-ray band unabsorbed luminosity of 2.3x10^{34} erg s^{-1} during days 71-140. The X-ray spectrum at this time requires a low Fe abundance (0.2^{+0.3}_{-0.1} solar), consistent with a Suzaku measurement around the same time. On day 315 we find a new X-ray spectral component which can be described by a blackbody with temperature of kT=23^{+9}_{-5} eV, while the previous hard X-ray component has declined by a factor of 3.8. The spectrum of this soft X-ray component resembles those typically seen in the class of supersoft sources (SSS) which suggests that the nova ejecta were starting to clear and/or that the WD photosphere is shrinking to the point at which its thermal emission reaches into the X-ray band. We find a high degree of variability in the soft component with a flare rising by an order of magnitude in count rate in 0.2 days. In the following observations on days 342.4-383.6, the soft component was not seen, only to emerge again on day 397. The hard component continued to evolve, and we found an anticorrelation between the hard X-ray emission and the UV emission, yielding a Spearman rank probability of 97%. After day 397, the hard component was still present, was variable, and continued to fade at an extremely slow rate but could not be analysed owing to pile up contamination from the bright SSS component.

Comments: 10 pages, 6 figures; accepted for AJ

Subjects: **High Energy Astrophysical Phenomena (astro-ph.HE)**; Galaxy Astrophysics (astro-ph.GA)

Cite as: arXiv:0902.2199v1 **[astro-ph.HE]**

The LaTeX Typesetting System

The vast majority of all astronomical journals use the "LaTeX" typesetting system to typeset and print papers. To cut production costs and guarantee that the final paper will be in format as intended by the author(s), each author is requested to draft the paper in the LaTeX language, and to submit the final manuscript as a LaTeX file. Almost every astronomer will inevitably become an expert on LaTeX over the course of his/her career.

A bit of history: LaTeX is a macro-package for TeX (pronounced "tech") which was created by Donald Knuth (Stanford U) in 1978 when he was horrified to see what the typesetters have done to his second version of his book "Art of Computer Programming". As a computer programmer, he was looking for a way to create a platform independent and flexible typesetting software for scientific/academic publications (with footnotes, floating figures and tables, etc).

So why not use a word processor? While easy to use, common word processors do not have the power and flexibility of LaTeX. A word processing user is formatting the text as they enter it, while the TeX user *describes the meaning* of the text and later, LaTeX will format it automatically. Complex annotations simply cannot be done with a word processor (e.g., equations) and overall, the formatting of the text does not look right.

A few reasons why LaTeX is superior to any other typesetting software:

- TeX has the best output, and text written with TeX looks superior.
- TeX is fast and easy on a computer's memory.
- TeX is stable and runs on all computer platforms.
- TeX is stable.
- TeX is very flexible. You can write your own style file with little effort.
- TeX's input is plain ASCII text.
- TeX's output can be anything: HTML, PDF, PS, DVI, etc.
- TeX is standard. Everyone uses it. Collaborators can easily share files.
- TeX is free.

As an example of the power of TeX/LaTeX try to write the following page with your favorite word processor.

62. $\displaystyle\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a}\arccos\frac{a}{|x|}, \quad a>0,$

63. $\displaystyle\int \frac{dx}{x^2\sqrt{x^2\pm a^2}} = \mp\frac{\sqrt{x^2\pm a^2}}{a^2x},$

64. $\displaystyle\int \frac{x\,dx}{\sqrt{x^2\pm a^2}} = \sqrt{x^2\pm a^2},$

65. $\displaystyle\int \frac{\sqrt{x^2\pm a^2}}{x^4}\,dx = \mp\frac{(x^2+a^2)^{3/2}}{3a^2x^3},$

66. $$\int \frac{dx}{ax^2+bx+c} = \begin{cases} \dfrac{1}{\sqrt{b^2-4ac}}\ln\left|\dfrac{2ax+b-\sqrt{b^2-4ac}}{2ax+b+\sqrt{b^2-4ac}}\right|, & \text{if } b^2>4ac, \\ \dfrac{2}{\sqrt{4ac-b^2}}\arctan\dfrac{2ax+b}{\sqrt{4ac-b^2}}, & \text{if } b^2<4ac, \end{cases}$$

67. $$\int \frac{dx}{\sqrt{ax^2+bx+c}} = \begin{cases} \dfrac{1}{\sqrt{a}}\ln\left|2ax+b+2\sqrt{a}\sqrt{ax^2+bx+c}\right|, & \text{if } a>0, \\ \dfrac{1}{\sqrt{-a}}\arcsin\dfrac{-2ax-b}{\sqrt{b^2-4ac}}, & \text{if } a<0, \end{cases}$$

68. $\displaystyle\int \sqrt{ax^2+bx+c}\,dx = \frac{2ax+b}{4a}\sqrt{ax^2+bx+c} + \frac{4ax-b^2}{8a}\int \frac{dx}{\sqrt{ax^2+bx+c}},$

69. $\displaystyle\int \frac{x\,dx}{\sqrt{ax^2+bx+c}} = \frac{\sqrt{ax^2+bx+c}}{a} - \frac{b}{2a}\int \frac{dx}{\sqrt{ax^2+bx+c}},$

70. $$\int \frac{dx}{x\sqrt{ax^2+bx+c}} = \begin{cases} \dfrac{-1}{\sqrt{c}}\ln\left|\dfrac{2\sqrt{c}\sqrt{ax^2+bx+c}+bx+2c}{x}\right|, & \text{if } c>0, \\ \dfrac{1}{\sqrt{-c}}\arcsin\dfrac{bx+2c}{|x|\sqrt{b^2-4ac}}, & \text{if } c<0, \end{cases}$$

71. $\displaystyle\int x^3\sqrt{x^2+a^2}\,dx = (\tfrac{1}{3}x^2 - \tfrac{2}{15}a^2)(x^2+a^2)^{3/2},$

72. $\displaystyle\int x^n\sin(ax)\,dx = -\tfrac{1}{a}x^n\cos(ax) + \tfrac{n}{a}\int x^{n-1}\cos(ax)\,dx,$

73. $\displaystyle\int x^n\cos(ax)\,dx = \tfrac{1}{a}x^n\sin(ax) - \tfrac{n}{a}\int x^{n-1}\sin(ax)\,dx,$

74. $\displaystyle\int x^n e^{ax}\,dx = \frac{x^n e^{ax}}{a} - \tfrac{n}{a}\int x^{n-1}e^{ax}\,dx,$

75. $\displaystyle\int x^n\ln(ax)\,dx = x^{n+1}\left(\frac{\ln(ax)}{n+1} - \frac{1}{(n+1)^2}\right),$

76. $\displaystyle\int x^n(\ln ax)^m\,dx = \frac{x^{n+1}}{n+1}(\ln ax)^m - \frac{m}{n+1}\int x^n(\ln ax)^{m-1}\,dx.$

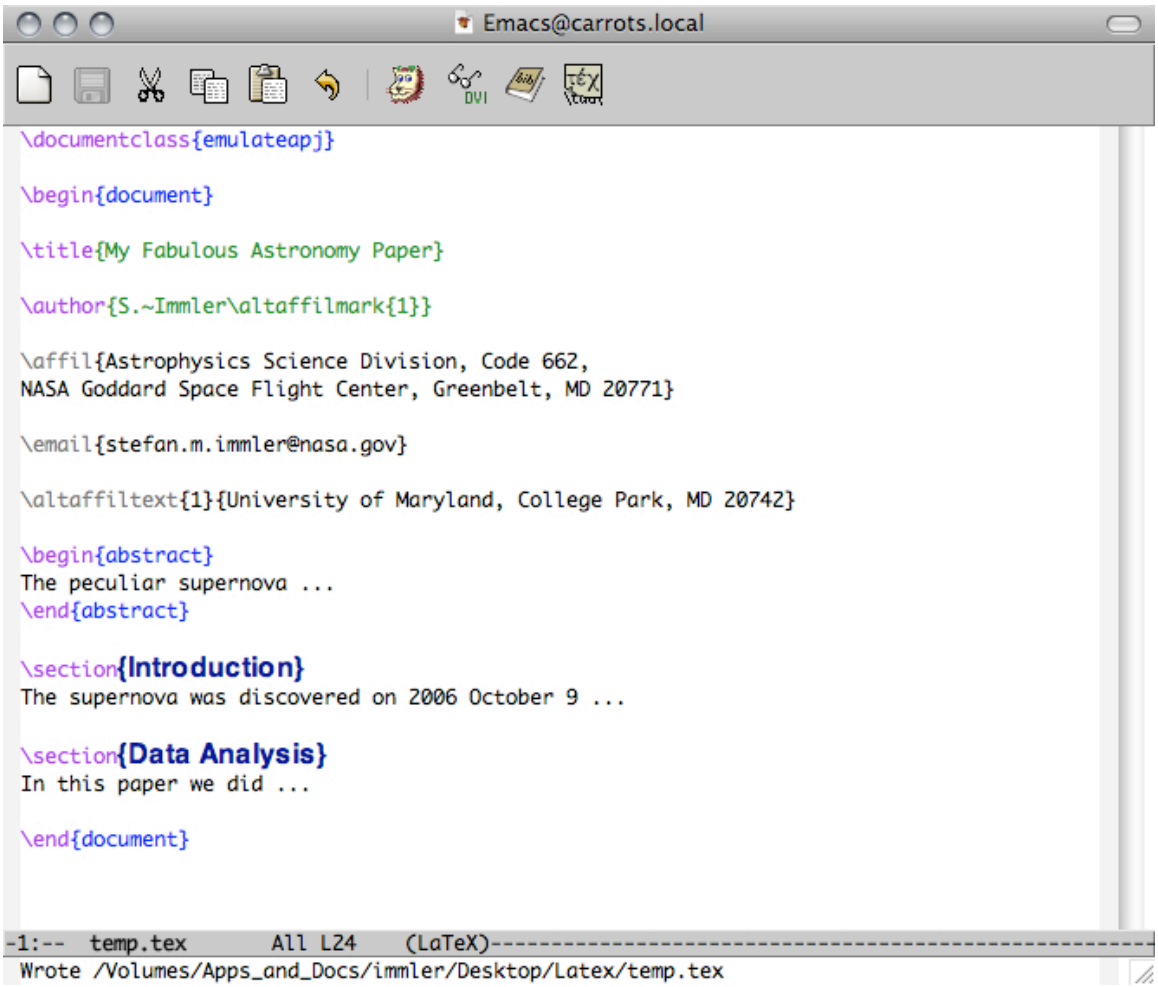
Where to get LaTeX

LaTeX is free can be downloaded from many different sites. Most Unix/Linux computers have LaTeX preinstalled. The main site for LaTeX is:

http://www.latex-project.org

LaTeX is *not* a word processor. Instead, LaTeX encourages authors *not* to worry too much about the appearance of their documents but to concentrate on getting the right content. Example:

The following sample file



produces this output:

MY FABULOUS ASTRONOMY PAPER

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Draft version February 16, 2009

ABSTRACT

The peculiar Type Ib supernova (SN) 2006jc has been observed with the UV/Optical Telescope (UVOT) and X-Ray Telescope (XRT) on board the § observatory over a period of 19 to 183 days after the explosion. Signatures of interaction of the outgoing SN shock with dense circumstellar material (CSM) are detected, such as strong X-ray emission ($L_{0.2-10} > 10^{39}$ erg s^{-1}) and the presence of Mg II 2800 Å line emission visible in the UV spectra. In combination with a Chandra observation obtained on day 40 after the explosion, the X-ray light curve is constructed, which shows a unique rise of the X-ray emission over a period of ~ 4 months, followed by a rapid decline. We interpret the unique X-ray and UV properties as a result of the SN shock interacting with a shell of material that was deposited by an outburst of the SN progenitor two years prior to the explosion. Before and after this outburst, the progenitor had a mass-loss rate in the range $\dot{M} \approx (0.5-1) \times 10^{-4}$ M$_\odot$ yr^{-1} (v_w/1500 km s^{-1}). Our results are consistent with the explosion of a Wolf-Rayet star that underwent an episodic mass ejection qualitatively similar to those of luminous blue variable stars prior to its explosion. This led to the formation of a dense ($\sim 10^6$ cm^{-3}) shell at a distance of $\sim 10^{16}$ cm from the site of the explosion, which expands with the WR wind at a velocity of (1300 ± 300) km s^{-1}.

Subject headings:

1. INTRODUCTION

SN 2006jc was discovered on 2006 October 9.75 (all times are UT) with an apparent magnitude of 13.8 in unfiltered CCD exposures (Nakano et al. 2006). No object was visible at the position of the SN on 2006 September 22 (limiting magnitude 19.0). Subsequent observations showed that the SN was around peak at the time of discovery (October 10.33: unfiltered magnitude 13.8, Nakano et al. 2006; October 13.67: Swift V-band magnitude 14.3, Brown, Immler & Modjaz 2006). Throughout this *Letter* we adopt an estimated explosion date around September 25 (±5 days). Approximately two years earlier (2005 October) a variable object ($\sim$ 18 mag) was discovered close to the position of SN 2006jc (0.″3 offset; Pastorello et al. 2007) which is thought to be associated with SN 2006jc.

SN 2006jc is a prime example that illustrates the inadequacy of the SN classification scheme (Types I, II and their subclasses): strong He I features in optical (350- to 740-nm) optical spectra suggested a Type Ib SN (Crotts et al. 2006), while the observed 610-nm Si II absorption feature is characteristic of Type Ia SNe at early times (Fesen et al. 2006). A very blue continuum, additional emission lines from He I 388.9-, 447.1-, and 501.5-nm and the absence of the broad peak at around 540 nm suggested that SN 2006jc is a very peculiar SN of a rare Type Ib variety, closely resembling SN 1999cq (Matheson et al. 2000) and SN 2002ao (Filippenko & Chornock 2002), which were also characterized by strong He I emission lines. However, the SN didn't show the He I lines as PCygni profiles typical for Type Ib SNe and as in the case of SN 1999cq (Matheson et al. 2000), which indicates that SN 2006jc might be a Type Ic SN. Since these differences in the spectra might be related to the different phases of Ib/c SNe and the heterogeneity of these subclasses, we will refer to SN 2006jc as a peculiar Type Ib/c SN.

2. DATA ANALYSIS

Type Ib/c SNe (see Filippenko 1997 for a review) are the result of the core collapse of a hydrogen-deficient, massive star (e.g., a Wolf-Rayet star); its outer layers were stripped by either mass transfer to a companion or by a strong stellar wind. Spectra of SNe Ib suggest that the progenitors have lost most of the H envelope, while progenitors of SNe Ic have lost the H layer and much of the He layer.

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```
\documentclass{article}
\begin{document}
This is a sample document.
```

produces the same output as

```
 \documentclass{article}
\begin{document}
This    is      a      sample     document.
```

because LaTeX takes care of the formatting for you.

Some Basic LaTeX Commands

LaTeX is a command-line software package that is very powerful. The downside is that you have to learn a lot of LaTeX commands. The best way to learn LaTeX is to read a manual. A good manual can be found here:

http://www.math.harvard.edu/texman/
http://www.giss.nasa.gov/tools/latex/

Math Commands:

```
The solution to $\sqrt{x} = 5$ is $x=25$.
```

Produces:

The solution to $\sqrt{x} = 5$ is $x = 25$.

```
The solution to

\begin{equation}
\sqrt{x} = 5.
\end{equation}

is

\begin{equation}
x=15.
\end{equation}
```

The solution to

$$\sqrt{x} = 5$$

is

$$x = 25.$$

Alternatively:
Use $$ instead of \begin{equation} and \end{equation}

```
Evaluate the sum $\sum\limits_{i=0}^n i^3$.
```

produces:

Evaluate the sum $\sum_{i=0}^{n} i^3$.

```
\begin{align*}
2x^2 + 3(x-1)(x-2) & = 2x^2 + 3(x^2-3x+2) \\
&= 2x^2 + 3x^2 - 9x + 6 \\
&= 5x^2 - 9x + 6
\end{align*}
```

produces:

$$\begin{aligned} 2x^2 + 3(x-1)(x-2) &= 2x^2 + 3(x^2 - 3x + 2) \\ &= 2x^2 + 3x^2 - 9x + 6 \\ &= 5x^2 - 9x + 6 \end{aligned}$$

Include Graphics:

```
\usepackage{graphics}
\includegraphics{image.ps}
```

You can also rotate images, specify the size, and add a caption:

```
\includegraphics[angle=45,width=5in,height=1in]{image.ps}
\caption{The above figure shows …}
```

Include Symbols:
Latex has more symbols than any word processor:

$\pm$	\pm	$\cap$	\cap	$\diamond$	\diamond	$\oplus$	\oplus
$\mp$	\mp	$\cup$	\cup	$\triangle$	\bigtriangleup	$\ominus$	\ominus
$\times$	\times	$\uplus$	\uplus	$\triangledown$	\bigtriangledown	$\otimes$	\otimes
$\div$	\div	$\sqcap$	\sqcap	$\triangleleft$	\triangleleft	$\oslash$	\oslash
$*$	\ast	$\sqcup$	\sqcup	$\triangleright$	\triangleright	$\odot$	\odot
$\star$	\star	$\vee$	\vee	$\lhd^b$	\lhd	$\bigcirc$	\bigcirc
$\circ$	\circ	$\wedge$	\wedge	$\rhd^b$	\rhd	$\dagger$	\dagger
$\bullet$	\bullet	$\setminus$	\setminus	$\unlhd^b$	\unlhd	$\ddagger$	\ddagger
$\cdot$	\cdot	$\wr$	\wr	$\unrhd^b$	\unrhd	$\amalg$	\amalg
$+$	+	$-$	-				

$\leq$	\leq	$\geq$	\geq	$\equiv$	\equiv	$\models$	\models
$\prec$	\prec	$\succ$	\succ	$\sim$	\sim	$\perp$	\perp
$\preceq$	\preceq	$\succeq$	\succeq	$\simeq$	\simeq	$\mid$	\mid
$\ll$	\ll	$\gg$	\gg	$\asymp$	\asymp	$\parallel$	\parallel
$\subset$	\subset	$\supset$	\supset	$\approx$	\approx	$\bowtie$	\bowtie
$\subseteq$	\subseteq	$\supseteq$	\supseteq	$\cong$	\cong	$\Join^b$	\Join
$\sqsubset^b$	\sqsubset	$\sqsupset^b$	\sqsupset	$\neq$	\neq	$\smile$	\smile
$\sqsubseteq$	\sqsubseteq	$\sqsupseteq$	\sqsupseteq	$\doteq$	\doteq	$\frown$	\frown
$\in$	\in	$\ni$	\ni	$\propto$	\propto	$=$	=
$\vdash$	\vdash	$\dashv$	\dashv	$<$	<	$>$	>
$:$	:						

α	\alpha	θ	\theta	o	o	τ	\tau
β	\beta	ϑ	\vartheta	π	\pi	υ	\upsilon
γ	\gamma	γ	\gamma	ϖ	\varpi	ϕ	\phi
δ	\delta	κ	\kappa	ρ	\rho	φ	\varphi
ϵ	\epsilon	λ	\lambda	ϱ	\varrho	χ	\chi
ε	\varepsilon	μ	\mu	σ	\sigma	ψ	\psi
ζ	\zeta	ν	\nu	ς	\varsigma	ω	\omega
η	\eta	ξ	\xi				

Γ	\Gamma	Λ	\Lambda	Σ	\Sigma	Ψ	\Psi
Δ	\Delta	Ξ	\Xi	Υ	\Upsilon	Ω	\Omega
Θ	\Theta	Π	\Pi	Φ	\Phi		

Table 1: Greek Letters

$\leftarrow$	\leftarrow	$\longleftarrow$	\longleftarrow	$\uparrow$	\uparrow
$\Leftarrow$	\Leftarrow	$\Longleftarrow$	\Longleftarrow	$\Uparrow$	\Uparrow
$\rightarrow$	\rightarrow	$\longrightarrow$	\longrightarrow	$\downarrow$	\downarrow
$\Rightarrow$	\Rightarrow	$\Longrightarrow$	\Longrightarrow	$\Downarrow$	\Downarrow
$\leftrightarrow$	\leftrightarrow	$\longleftrightarrow$	\longleftrightarrow	$\updownarrow$	\updownarrow
$\Leftrightarrow$	\Leftrightarrow	$\Longleftrightarrow$	\Longleftrightarrow	$\Updownarrow$	\Updownarrow
$\mapsto$	\mapsto	$\longmapsto$	\longmapsto	$\nearrow$	\nearrow
$\hookleftarrow$	\hookleftarrow	$\hookrightarrow$	\hookrightarrow	$\searrow$	\searrow
$\leftharpoonup$	\leftharpoonup	$\rightharpoonup$	\rightharpoonup	$\swarrow$	\swarrow
$\leftharpoondown$	\leftharpoondown	$\rightharpoondown$	\rightharpoondown	$\nwarrow$	\nwarrow
$\rightleftharpoons$	\rightleftharpoons	$\leadsto^b$	\leadsto		

$\ldots$	\ldots	$\cdots$	\cdots	$\vdots$	\vdots	$\ddots$	\ddots
$\aleph$	\aleph	$\prime$	\prime	$\forall$	\forall	∞	\infty
$\hbar$	\hbar	$\emptyset$	\emptyset	$\exists$	\exists	$\Box$	\Box^b
$\imath$	\imath	∇	\nabla	$\neg$	\neg	$\Diamond$	\Diamond^b
$\jmath$	\jmath	$\surd$	\surd	$\flat$	\flat	$\triangle$	\triangle
ℓ	\ell	$\top$	\top	$\natural$	\natural	$\clubsuit$	\clubsuit
$\wp$	\wp	$\bot$	\bot	$\sharp$	\sharp	$\diamondsuit$	\diamondsuit
$\Re$	\Re	$\|$	|	$\backslash$	\backslash	$\heartsuit$	\heartsuit
$\Im$	\Im	$\angle$	\angle	∂	\partial	$\spadesuit$	\spadesuit
$\mho$	\mho^b	.	.	$\|$	|		

$\sum$	\sum	$\bigcap$	\bigcap	$\bigodot$	\bigodot
$\prod$	\prod	$\bigcup$	\bigcup	$\bigotimes$	\bigotimes
$\coprod$	\coprod	$\bigsqcup$	\bigsqcup	$\bigoplus$	\bigoplus
$\int$	\int	$\bigvee$	\bigvee	$\biguplus$	\biguplus
$\oint$	\oint	$\bigwedge$	\bigwedge		

Table 7: Variable-sized Symbols

(	(	)	)	$\uparrow$	\uparrow	$\Uparrow$	\Uparrow
[	[	]	]	$\downarrow$	\downarrow	$\Downarrow$	\Downarrow
{	\{	}	\}	$\updownarrow$	\updownarrow	$\Updownarrow$	\Updownarrow
$\lfloor$	\lfloor	$\rfloor$	\rfloor	$\lceil$	\lceil	$\rceil$	\rceil
$\langle$	\langle	$\rangle$	\rangle	/	/	$\backslash$	\backslash
$\|$	|	$\|$	|				

Table 9: Delimiters

$\rmoustache$	`\rmoustache`	$\lmoustache$	`\lmoustache`	$\rgroup$	`\rgroup`	$\lgroup$	`\lgroup`
$\arrowvert$	`\arrowvert`	$\Arrowvert$	`\Arrowvert`	$\bracevert$	`\bracevert`		

Table 10: Large Delimiters

$\hat{a}$	`\hat{a}`	$\acute{a}$	`\acute{a}`	$\bar{a}$	`\bar{a}`	$\dot{a}$	`\dot{a}`	$\breve{a}$	`\breve{a}`
$\check{a}$	`\check{a}`	$\grave{a}$	`\grave{a}`	$\vec{a}$	`\vec{a}`	$\ddot{a}$	`\ddot{a}`	$\tilde{a}$	`\tilde{a}`

Table 11: Math mode accents

$\widetilde{abc}$	`\widetilde{abc}`	$\widehat{abc}$	`\widehat{abc}`
$\overleftarrow{abc}$	`\overleftarrow{abc}`	$\overrightarrow{abc}$	`\overrightarrow{abc}`
$\overline{abc}$	`\overline{abc}`	$\underline{abc}$	`\underline{abc}`
$\overbrace{abc}$	`\overbrace{abc}`	$\underbrace{abc}$	`\underbrace{abc}`
$\sqrt{abc}$	`\sqrt{abc}`	$\sqrt[n]{abc}$	`\sqrt[n]{abc}`
f'	`f'`	$\frac{abc}{xyz}$	`\frac{abc}{xyz}`

Table 12: Some other constructions

How do you run LaTeX?

LaTeX is run in command-line mode. You can use any ASCII editor to edit your file, such as “emacs”, “Xemacs” (emacs with a graphical menu), “vi”, etc.

Imagine you write your paper with Xemacs, e.g.:

> xemacs paper.tex &

which bring up the emacs graphical interface and frees the terminal (“&”):

After you edited the paper, you need to compile it:

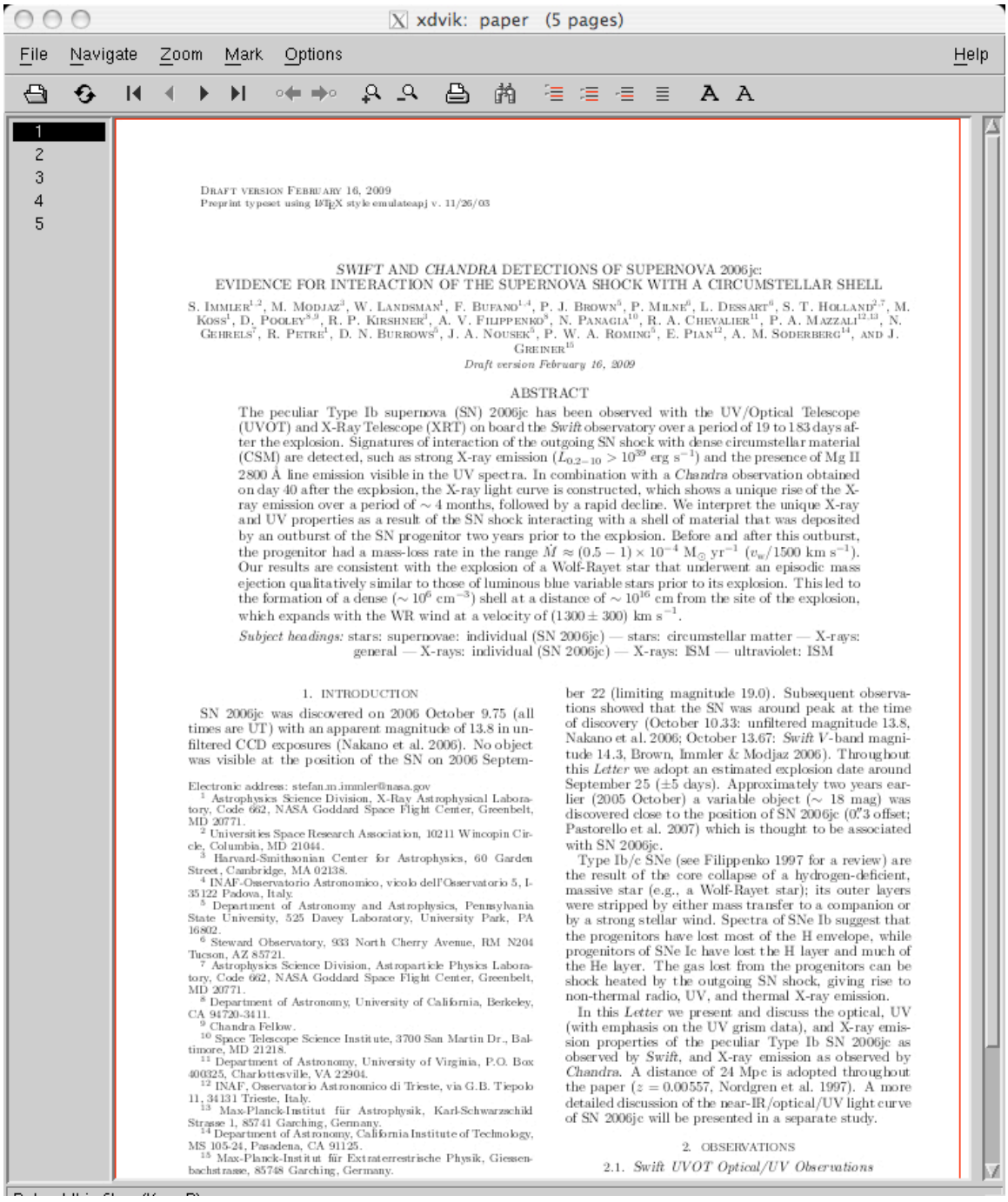
> latex paper.tex &

Output written on paper.dvi (1 page, 1516 bytes).
Transcript written on paper.log.

LaTeX has now produced a “device independent file”, paper.dvi. It is often necessary to compile a LaTeX file two or three times so that LaTeX can build internal indexes and use them.

You can display the output by typing:

> xdvi paper.dvi &



Next, produce a **Postscript file**:

```
> dvips paper.dvi –o paper.ps
```

You can look at this file with the Ghostview application:

```
> gv paper.ps &
```

or convert it into a **PDF file**:

```
> ps2pdf paper.ps paper.pdf
```

or create a **HTML file**:

```
> latex2html paper.tex
```

which creates the HTML file “paper.html” that you can upload to a web site.

Lab Work

Today's lab will be devoted to the homework assignment.

- Use ADS at http://adsabs.harvard.edu/default_search/ to search for refereed literature.
- Search for papers by an author by entering the author's name in the "Authors" box in the form LASTNAME, INITIALS. For example, "Einstein, A".
- Put a carat "^" infront of the author's name to only search for papers where the author is the first author. For example, "^Fermi, E".
- To only search for refereed publications go to the "Filters" section of the Web form and select "All refereed articles".
- Searches can be constrained by enter terms in the "Objects", "Title", and "Abstract" fields. Check the appropriate "Require <whatever> for selection" boxes when specifying multiple fields (such as Object and Title).

- The preprint archive at `http://arxiv.org/` has a simple search interface. Click on "find" for the appropriate discipline and then enter author, title, or abstract keywords to search for.
- When you have search results click on the catalogue number (for example, arXiv:0901.0123) to get the abstract of that paper and other information.

- To do the LaTeX part of the assignment go to the course Web page and download the four homework 3 files. Put them in your working directory. The files are
  - emulateapj.cls
  - figure.ps
  - paper.tex
  - psfig.sty

  Do not edit any of these files except *paper.tex.*
- Edit paper.tex so that contains all of the needed LaTeX markup commands. Some of the markup is already present in the file.
- To compile and view LaTeX
  - `latex paper.tex`
  - `latex paper.tex`
  - `xdvi paper.dvi`
  - `dvips paper.dvi -o paper.ps`
  - `ps2pdf paper.ps paper.pdf`
- It is often necessary to run LaTeX several times so that internal indexes can be constructed and applied.
- `xdvi` start a viewer that will let you see the compiled paper.
- `dvips` converts a dvi file into a postscript file that can be printed.
- `ps2pdf` converts a postscript file into a PDF file.